PCT 404

(19) JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: 09298673 A

(43) Date of publication of application: 18.11.97

(51) Int. Cl H04N 1/46
G06T 1/00
G09G 5/06
G09G 5/36
H04N 1/60

(21) Application number: 08132544

(22) Date of filing: 01.05.96

(71) Applicant: CASIO COMPUT CO LTD

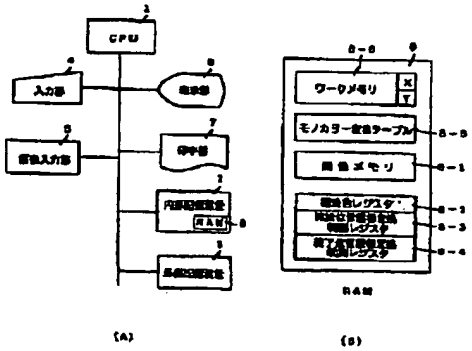
(72) Inventor: MAEDA JUNICHI

(54) IMAGE PROCESSOR

(57) Abstract:

PROBLEM TO BE SOLVED: To efficiently convert full-color images to the monochromatic images of a desired color by one operation or easy operations close to it.

SOLUTION: An optional color is selectively specified from the respective kinds of the colors decided beforehand from an input part 4. Then, a CPU 1 scans the respective pixels of the full-color images, calculates luminance from the RGB value, accesses a mono-color conversion table 8-5 corresponding to the specified color and retrieves the mono-color conversion table 8-5 by the calculated luminance. Thus, when the luminance is converted to the RGB value of the specified color, the CPU 1 replaces the RGB value of the full-color images to the RGB of the specified color.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the image processing system which changes a full color image into a monochrome image in a personal computer, a word processor, etc.
[0002]
[Description of the Prior Art] Conventionally, if the color of not only a monochrome (achromatic color) monochrome image but arbitration was specified, he is trying to change into the monochrome image of the specified color, when a full color image is changed into a monochrome image in image processing systems, such as a personal computer, but when specifying the color of arbitration, the following procedures were performing. That is, while operating the pointing device and directing image edit of a color picture, color specification was performed by directing color tone amendment and directing the hue, saturation, and lightness after that according to the color for which it asks. Thus, assignment of the color of arbitration changes a full color image into the monochrome image of an assignment color according to an image-processing program.
[0003]
[Problem(s) to be Solved by the Invention] However, in the former, while needing the above complicated actuation, since the advanced knowledge about a color was needed, a hue, saturation, lightness, etc. had applied the big burden to the operator. Moreover, since an image-processing program analyzed the specified hue, saturation, and lightness and he was trying to specify an assignment color according to the analysis result, it caused huge-ization of a program and also had the problem that processing effectiveness worsened so much. The technical problem of this invention is enabling it to change into the monochrome image of the color which asks for a full color image by easy actuation near one-touch or it efficiently.
[0004]
[Means for Solving the Problem] The means of this invention is as follows. In the image processing system which changes a full color image into a monochrome image, (1) and an assignment means specify the color of arbitration alternatively out of various kinds of colors decided beforehand, and perform color specification by operating a keyboard and a pointing device for example.
(2) and a calculation means scan each pixel which constitutes said color picture, and compute brightness from the color component. Here, a color picture may be a YMC image for printing which uses as a color component not only the RGB image for a display that uses red-green blue as a color component but yellow, a Magenta, and cyanogen.
(3) and a conversion means change the brightness computed by this calculation means into the color component of the assignment color specified by said assignment means.
(4) and a permutation means transpose the color component of each pixel which constitutes said color picture to the color component of an assignment color into which it was changed by said conversion means. In addition, when the key of arbitration is operated among the color specification keys prepared corresponding to various kinds of colors decided beforehand, you may make it said assignment means specify the color corresponding to the key concerned. Moreover, it matches with said various kinds of colors, is prepared, respectively, and has two or more translation tables which change into the color component of a single color the brightness computed by said calculation means, and you may make it said conversion means change into the color component of said assignment color the brightness computed by said calculation means by referring to the translation table corresponding to said assignment color among said two or more translation tables. Moreover, while said conversion means changes into the color component corresponding to two or more of said assignment colors the brightness computed by said calculation means, respectively, it may make change it into the color component of the mixed color which mixed two or more of said assignment colors by combining each changed color component according to the regulation which was able to be decided beforehand, when two or more colors are specified by said assignment means. Furthermore, when two or more colors are specified by said assignment means, while said conversion means changes into the color component corresponding to said two or

more assignment colors the brightness computed by said calculation means, respectively Each changed color component is compared for every component, and you may make it change into the color component of the mixed color which mixed said two or more assignment colors by extracting and combining the largest value out of it. Now, in changing a full color image into a monochrome image, it specifies the color of arbitration out of various kinds of colors decided beforehand. Then, since each pixel which constitutes a color picture is scanned and brightness is computed from that color component (for example, RGB value), a conversion means changes this brightness into the color component of an assignment color. The color component of each pixel which constitutes a color picture by this is transposed to the color component of the changed assignment color. Therefore, it is efficiently convertible for the monochrome image of the color which asks for a full color image by easy actuation near one-touch or it.
[0005]
[Embodiment of the Invention]
(The 1st operation gestalt) With reference to drawing 1 - drawing 6 , the 1st operation gestalt of this invention is explained hereafter. Drawing 1 (A) is the block block diagram of an image processing system. CPU1 is arithmetic and program control which controls actuation by this whole image processing system according to the program in internal storage 2. Internal storage 2 consists of RAM, cache memory, ROM, etc., and a called program and data are loaded to internal storage 2 from external storage 3. In addition, external storage 3 may be the memory card with which magnetic / an optical storage medium, or semiconductor memory is consisted of, and it equips free [attachment and detachment], a floppy disk, an add-in board, etc. Moreover, the program and data which have been transmitted from other devices through a communication line may be received and memorized.
[0006] The input section 4 has the composition of having POINTIGU devices, such as key input equipment equipped with various kinds of function keys, cursor keys, etc., and a mouse. Here, in case a full color image is changed into a monochrome image, in order to choose the color of a monochrome image, the color of arbitration is specified by key input out of various kinds of colors decided beforehand. In this case, various kinds of colors which are the candidates for selection are matched with the function key by 1:1, and perform color specification by operating the function key of arbitration. That is, a function key is arranged on a touch screen and performs color specification by carrying out the touch input of the function key of the color which inspects visually and asks for the function name display on the display screen (color name). In addition, he is trying to specify one color of arbitration out of eight kinds of colors in this case.
[0007] The image input section 5 is constituted by the digital camera and the image scanner. In addition, a digital camera is the electronic still camera or video camera which carries out analog-to-digital conversion while carrying out photo electric conversion of the photographic subject image received by the solid state image sensor, and image scanners are image sensors which scan printed matter etc. and obtain a digital image, and are connected removable to the image processing system. And the image input section 5 inputs a full color image, generates the color picture for printing and makes it to make the displays 6, such as a liquid crystal display, indicate by multicolor, or to answer a printing command from the input section 4, to carry out RGB/YMCK conversion of this full color image, and it carry out process printing from the printing sections 7, such as a thermal printer, while CPU1 captures the full color image inputted from the image input section 5 and stores it in internal storage 2.
[0008] Drawing 1 (B) is what showed a part of RAM8 which constitutes internal storage 2, and an image memory 8-1 is image memory which stores the image data by which external supply was carried out through external storage 3 or communication lines, such as image data, a floppy disk, etc. which were inputted from the image input section 5, as a bit map image data for every RGB. In case the assignment color register 8-2 changes a full color image into the monochrome image of the color of arbitration, it is a register which stores temporarily the color specified by the key stroke. Although a cursor key is operated and the conversion range is specified here in case a full color image is changed into a monochrome image, in that case, the starting position coordinate transformation range register 8-3 stores temporarily the starting position coordinate of the specified conversion range, and the termination position-coordinate conversion range register 8-4 is a register for storing the termination position coordinate temporarily. The mono-color translation table 8-5 is a table referred to in case a full color image is changed into the monochrome image of an assignment color, and eight kinds of mono-color translation tables 8-5 are formed by matching with eight kinds of colors beforehand decided as a candidate for selection of an assignment color 1:1. Drawing 2 is what showed some mono-color translation tables 8-5, drawing 2 (A) shows the mono-color translation table 8-5 corresponding to "blue", and (B) shows the mono-color translation table 8-5 corresponding to "red." The mono-color translation table 8-5 has the composition of memorizing a RGB value (256 gradation) corresponding to the brightness value of 256 gradation. CPU1 accesses the mono-color translation table 8-5 corresponding to the contents of the assignment color register 8-2 here out of eight kinds of mono-color translation tables 8-5. Although a full color image is changed into the monochrome image of an assignment color by referring to the contents of this mono-color translation table 8-5 In that case, CPU1 scans each pixel which constitutes a full color image, computes brightness from that RGB value, searches

the mono-color translation table 8-5 based on this brightness, and calculates the RGB value of an assignment color. The work-piece memory 8-6 has X register and Y register which memorize the scan coordinate which scans a full color image for every pixel. Here, CPU1 scans at a time the conversion range of 1 pixel shown among the full color images in an image memory 8-1 according to the contents of the starting position coordinate transformation range register 8-3 and the termination position-coordinate conversion range register 8-4, carrying out renewal of sequential of the value of X register and Y register.

[0009] Next, it explains with reference to the flow chart which shows the actuation at the time of changing a full color image into a monochrome image in this image processing system to drawing 3 and drawing 4 . In addition, the program for realizing each function described by this flow chart is the gestalt of the program code which CPU1 can read, is memorized by internal storage 2 fixed, or is loaded to internal storage 2 from external storage 3. Now, each function key is assigned to the processing facility as shown in drawing 5 ** in the image-processing waiting state (primitive state) (step A1). Here, if a function key F4 is operated and image edit is directed, each function key is assigned to a processing facility as shown in drawing 5 **, and will be in the state waiting for selection of image edit (step S2).

[0010] Here, if a function key F9 is operated in order to specify the processing which changes a full color image into a monochrome image, it will become the assignment color waiting of into what kind of color to make a monochrome image (step A3). In this case, since eight kinds of colors beforehand decided as a color for selection are matched with 1:1, function keys F1-F8 come to function as a color specification key, respectively. Drawing 6 shows the function key in this case, and function keys F1-F8 are matched with "black", "yellow", "red", "blue", a "sour orange", green ["green"], "purple", and "sepia." In addition, a function key F9 functions as activation which directs termination of color specification. Here, if any or one key is operated among function keys F1-F8, the color code corresponding to the key concerned will be set to the assignment color register 8-2 in RAM8 as an assignment color (step A4). Thus, if color specification is performed, CPU1 will serve as starting position assignment waiting of the conversion range (step A5).

[0011] If an Enter key is now operated after setting cursor to the starting position of the conversion range since cursor is moved onto the display screen (step A6) whenever a cursor key is operated, CPU1 will incorporate a current cursor location coordinate as a starting position coordinate, and will set it to the starting position coordinate transformation range register 8-3 (step A7). Next, it becomes the termination tab-control-specification waiting of the conversion range (step A8), and similarly, if an Enter key is operated, operating a cursor key after setting to the location which asks for cursor (step A9), CPU1 will incorporate a current cursor location coordinate as a termination position coordinate, and will set it to the termination position-coordinate conversion range register 8-4 (step A10). The display screen shown in drawing 5 is what showed the condition of having specified the field of the arbitration of an image display within the limit as conversion range, and when specifying the conversion range of rectangular, it is performed by specifying two points, the upper left coordinate and lower right coordinate, as mentioned above. And it progresses to step A11 of drawing 4 , and becomes the activation waiting of transform processing.

[0012] Here, if an Enter key is operated, CPU1 will scan the full color image stored as a candidate for conversion in the image memory 8-1, and will acquire a RGB value (step A12). First, in order to scan the upper left pixel of conversion within the limits among each pixel which constitutes a full color image, CPU1 sets the value of the starting position coordinate transformation range register 8-3 to X register and Y register, and acquires the RGB value of the pixel specified with this X register and Y register. And the brightness K of that pixel is computed according to a degree type from this RGB value. While specifying the mono-color translation table 8-5 corresponding to the contents of the assignment color register 8-2 among "8+G [K=3R/8+B/]/2", next eight kinds of mono-color translation tables 8-5 (step A14), based on the computed brightness, the mono-color translation table 8-5 concerned is searched, and a corresponding RGB value is acquired (step A15). When a brightness value is now and an assignment color is "129" in "red", "R= 255, G= 2, B= 2" are read from the mono-color translation table 8-5 shown in drawing 2 (B) as a "red" RGB value.

[0013] Thus, replacement of a RGB value is performed between the RGB value of the assignment color acquired from the mono-color translation table 8-5, and the RGB value of the original full color image (step A16). That is, the RGB value of the pixel (it is the upper left pixel of conversion within the limits at first) shown with the value of X register and Y register is replaced with the RGB value of the assignment color obtained by referring to the mono-color translation table 8-5. And although it confirms whether the lower right pixel of conversion within the limits was specified (step A17), it is carried out by detecting whether the value of X register and Y register became equal to the value of the termination position-coordinate conversion range register 8-4 in this case. Since it is the case where the upper left pixel is specified now, the value of X register and Y register is updated and the following pixel is specified (step A18). And the RGB value of the assignment pixel concerned is acquired (step A12), and the same processing is hereafter repeated for every pixel. If sequential conversion is carried out by this and the full color image of conversion within the limits finishes changing all into the monochrome image of an assignment color to the lower right pixel of the range by it (step A17), the display output of the changed monochrome image will be carried out (step A19). And it

becomes step A1 with return and a primitive state. Here, if a function key F8 is operated, hard copy of the monochrome image on the display screen will be carried out, and if a function key F5 is operated, registration preservation of it will be carried out at external storage 3.
[0014] It becomes possible to simplify an image-processing program so much as mentioned above, while being able to change into the monochrome image of the color which asks for a full color image by very easy actuation since the color matched with that function key is chosen as an assignment color as the one-touch input of the function key is carried out in case it specifies in what kind of single color a monochrome image is expressed in this image processing system. Moreover, the mono-color translation table 8-5 is formed for every color of the various kinds beforehand decided as a candidate for selection, and since it was made to perform conversion in a monochrome image from the inside with reference to the mono-color translation table 8-5 corresponding to an assignment color, it becomes possible to also perform transform processing efficiently.
[0015] (The 2nd operation gestalt) With reference to drawing 7 - drawing 10 , the 2nd operation gestalt of this invention is explained hereafter. In addition, if two or more colors are chosen out of various kinds of colors decided beforehand, it is made to change into the monochrome image of a mixed color with which the selected color was mixed in this 2nd operation gestalt. Drawing 7 and drawing 8 are the flow charts which showed the actuation at the time of changing a full color image into the monochrome image of an assignment color. First, although it will be in the same state waiting for a key input as steps A1 and A2 of drawing 3 , the illustration abbreviation has been carried out in drawing 7 . If image edit is now directed from a primitive state, it will progress to step B1 and will become the waiting for color specification. Here, as shown in drawing 9 , each function keys F1-F8 function as a color specification key like the case of the 1st operation gestalt mentioned above. Moreover, the subwindow which shows the assignment condition of a mixed color opens, and a list indication of the name of each color corresponding to function keys F1-F8 is given.
[0016] Here, although it is the same as that of the case of drawing 3 that the color corresponding to the key is set to the assignment color register 8-2 if one of function keys is operated in order to specify the color of arbitration (step B-2), the inverse video of the name in the above-mentioned subwindow corresponding to an assignment color is carried out (step B3). And whenever the color of return and arbitration is specified as step B1, steps B1-B3 are repeated. Here, the contents of a display of a subwindow shown in drawing 9 show the condition that "purple" was chosen with "red." Thus, if two or more colors are specified and a function key F9 (Enter key) is operated, and it progresses to step B4, whether two or more colors were specified checks and it is not specified, it returns to step B1. In addition, when operating a function key and specifying two or more colors, you may make it specify two or more colors at once by carrying out coincidence push of the two or more [besides in the case of operating one function key at a time] keys. If "red" and "purple" should be specified now, it will progress to step B5 and conversion range assignment processing will be performed. Since this range assignment processing is the same as that of step A5-A10 of drawing 3 , the illustration abbreviation of that detail has been carried out.
[0017] And if it will be in an activation waiting-acknowledgement condition (step B6) and an Enter key is operated, the actuation which changes a full color image into a monochrome image will be started. Here, steps B7 and B8 are the same processings corresponding to steps A12 and A13 of drawing 3 , acquire a RGB value from the pixel of the full color image shown with a coordinate (X, Y), and calculate brightness from this RGB value. And the RGB value of the pixel shown with a coordinate (X, Y) is reset to "0", respectively (step B9). In addition, this processing is performed as pretreatment of comparison processing of the RGB value mentioned later. Next, although it progresses to step B10 of drawing 8 , since two or more colors are set to the assignment color register 8-2 in this case, first, the color of that head is called and the mono-color translation table 8-5 corresponding to it is specified. And with reference to this mono-color translation table 8-5, the RGB value of the assignment color corresponding to the computed brightness is acquired (step B11).
[0018] Next, the size of the RGB value (image RGB value) of the full color image scanned with the coordinate (X, Y) and the RGB value (acquisition RGB value) acquired from the mono-color translation table 8-5 is compared for every color component (step B12). That is, it investigates whether as compared with every "R", "G", and "B", the acquisition RGB value is larger than an image RGB value in an image RGB value and an acquisition RGB value. Since all image RGB values are reset by "0" at first, with [an acquisition RGB value] "1", it progresses to step B13 and processing which rewrites an image RGB value to an acquisition RGB value is performed. [more than] For example, if the RGB values acquired from the "blue" mono-color translation table 8-5 are "0, 0,255" as shown in drawing 10 , the color component B of an image will be rewritten by "255."
[0019] Next, it investigates whether there are any remaining assignment colors with reference to the assignment color register 8-2 (step B14), and if it is, the next color in the assignment color register 8-2 will be specified (step B15). And the same actuation is repeated by step B10 return and the following. Now, as shown in drawing 10 , "red" should be specified as a following color, and the RGB value "255, 0, 0" should be acquired from the mono-color translation table

8-5. Since the image RGB value is "0, 0,255" at this time, the value of the color component R of an image is transposed to the value "255" of Acquisition R (step B13). By this, an image RGB value turns into a RGB value of the mixed color which mixed 2 Colors of "blue" and "red" "255, 0, 0." And if it remains at step B14 and nothing ****** of the assignment color is carried out, return and the actuation as **** with 1 pixel same at a time will be repeated for the following pixel to step B7 assignment (step B17) and the following until it investigates whether processing finished (step B16) and ends to the last pixel (lower right pixel) of the conversion range. And if processing finishes to a lower right pixel, the display output of the monochrome image will be carried out (step B18).

[0020] In this case, the mixed color and monochrome image with which two or more colors specified as arbitration were mixed carry out a display output. Thus, since the monochrome image of the mixed color which combined it by specifying two or more colors out of eight kinds of colors currently assigned to function keys F1-F8 as a candidate for selection is outputted, it becomes possible to extend the selection range of a color sharply not only according to eight kinds but according to its combination. Moreover, if two or more function keys are pushed at coincidence and two or more colors are specified as mentioned above, assignment of a mixed color will be attained in an one-touch input.

[0021] In addition, if the brightness is reversed when each pixel which constitutes a full color image is scanned and brightness is computed from the RGB value, a reversal monochrome image can be obtained. Moreover, you may make it choose an assignment color by making a window indicate various kinds of colors decided beforehand by list, in case color specification is performed, and carrying out tab control specification of the color of arbitration with a pointing device from the inside. Furthermore, it may be made to specify a color by operating a kana letter key and inputting the name of a color.

[0022]

[Effect of the Invention] According to this invention, a full color image is efficiently convertible for the monochrome image of an assignment color only by specifying the color of arbitration out of various kinds of colors decided beforehand. Especially, the knowledge about complicated actuation or a color is not needed, but it becomes convertible into a monochrome image by the easy actuation near one-touch or it.

[Translation done.]